January 21, 2000
Permit No. TA001RE

Work Plan for:
Surface Erosion and Stability Analysis
Tailings Dam Facility
Molycorp, Inc. - Questa Division

1. Background, Rational, Objectives and Timing

1.1 Background

On December 30, 1999 the New Mexico Mining and Minerals Division approved an extension for approval of the closeout plan for the tailings area. The extension included tasks yet to be completed. The Surface Erosion and Stability Analysis Work Plan was originally due December 31, 1999 and is currently due and being submitted on January 21, 2000.

1.2. Rationale

The Surface Erosion and Stability analysis at the tailings facility is designed to ensure that long term stability of all structures will be achieved and a self-sustaining ecosystem will be in place at the tailings dam facility upon final closure. The current tailings facility is well-suited to this analysis because in some areas the vegetation has been in place for over twenty years and will be a good representation of post-closure conditions. Monitoring of the stability of the various structures has been a requirement by the State Dam Safety Engineer throughout the operating life of the structure.

1.3 Objective

The objective of the surface erosion and stability analysis is to:

For erosion to quantify, where possible, evaluate, and set up test plots to determine the surface erosion potential and identify measures to minimize post closure erosion; and

For stability to demonstrate the long term stability (post closure) of all embankments (dams) and diversion structures which form the tailings facility.

1.4 Timing

The work plan is submitted January 21, 2000 with a 30-day review and revision period. The work will take place from March 1 to April 30, 2000 with the report submitted May 31, 2000. The projected hearing date for the revised closure plan (DP-933 modification) and the closeout plan is the end of July 2000.

2. Scope of work

2.1 Evaluation of the surface erosion potential of the tailings area

There is minimal erosion of the tailings surface areas. A reconnaissance survey will be performed of the tailings surface area to describe any areas where erosion is observed. The nature and extent of any erosion will be described, including descriptions of the vegetation and surface materials, and the cause of the erosion.

Ten plots will be set up to visually evaluate erosional conditions or potential erosion. Semi-permanent plots will be set up to do visual evaluations in subsequent years in the same locations. (The plots are considered semi-permanent because some may eventually be used for further tailings deposition). Information to be included will be amount of cobble and/or gravel in the cover, vegetation density and estimated slope. Types of erosion or potential for erosion will be documented, including effects of water and wind.

Predictions will be made of the potential for future erosion using RUSLE 1.06 (for mined lands, construction and reclaimed lands) and the methods and techniques developed Abt and Nelson. Where feasible, inputs will be based on actual site conditions and these will be enumerated in the report.

The majority of the work relating to tailings surface vegetation that will be completed for submittal May 31, 2000 will be based on information and data already collected. Although vegetation test plots will be installed as indicated in previous correspondence, the data from these plots will not be available in the initial report. However, supplemental information will be provided as the data is collected and analyzed.

2.2 Evaluation of the tailings dam slopes

a) Surface erosion:

1) Surface erosion will be visually evaluated and documented on the dam faces of concern (Dam 1 and Dam 4, Dam 5a is a rock dam). Types of erosion will be categorized based on the visual evaluation (i.e., rill, sheet, etc.).
2) A minimum of two plots will be set up, one on each dam face, to measure any current surface erosion. Selection of the locations will be based on field conditions, access and will be located near the base of the dam where erosion effects would be most pronounced.
3) Surface erosion will be visually evaluated and documented along each of the diversion ditches.

4) The potential surface erosion will be predicted using the Revised Universal Soil Loss Equation (RUSLE 1.06) for mined lands, construction sites and reclaimed lands. The use of alternative erosion assessment methods such as those developed by Abt, Nelson and others will also be considered to best estimate the potential for future erosion and the benefits of alternative erosion control measures. Where feasible, inputs will be based on actual site conditions and these will be enumerated in the report.
5) Alternative control measures will be evaluated including the use of surface armoring or rip-rap and additional water management measures.

b) Stability:

1) Stability of the dams is currently being monitored and provided to the State Engineers Offices (SEO) on a quarterly basis. The dams are inspected quarterly by a registered Professional Engineer and reports compiled in the quarterly report. Additionally, monthly piezometer readings are included in this report. The most recent two quarterly reports will be provided to provide documentation on the stability of the dams.
2) On an annual basis, these reports will be provided to MMD and NMED on the dam stability.
3) Post-mine closure, the phreatic surface within the tailings impoundments will reduce as pore water drains from the tailings impoundments. Stability analyses will be performed of the long term post-closure stability conditions of the tailings embankments using conventional circular arc and block failure analyses methods for both static an pseudo-static conditions applicable to the site The results of these analyses will be included in the report to be submitted on May 31, 2000. The work will be done under the direct supervision of a registered professional engineer.

3.0 References

A bibliography of references applicable to erosion assessment methods and control is attached indicating some of the recent technology trends applicable to the erosion control for tailings dams and covers.